East Waterway OU

Anthropogenic Background Small Working Group Meeting #2

Invitees: EPA, East Waterway Group (Port of Seattle, City of Seattle, and King County) Muckleshoot Tribe, Suquamish Tribe

November 16, 9 – 10:30 am

Agenda

1. PCB summing
2. Dioxin/furan summing
3. Sediment traps
4. Initial outlier analysis
5. Work products for Meeting #3

Attachments

Small Group Meeting #2 presentation

Attendees

EPA

- Ravi Sanga
- Elizabeth Allen

USACE (on behalf of EPA)

- Bill Gardiner

Suquamish Tribe

- Alison O'Sullivan

East Waterway Group (EWG)

- Brick Spangler (Port of Seattle)
- Jeff Stern (King County)
- Debra Williston (King County)
- Pete Rude (City of Seattle)
- Allison Crowley (City of Seattle)
- Merv Coover (ERM on behalf of the City)
- Dan Berlin (Anchor QEA on behalf of EWG)
- Greg Brunkhorst (Anchor QEA on behalf of EWG)
- Deb Chiavelli (Anchor QEA on behalf of EWG)

Meeting Notes

Dan: Welcome, this is small group meeting #2. Our 3rd small group meeting is this Friday.

Ravi: I'd like to see meeting notes for these meetings. I have been sending all meeting notes to everyone, including the tribes.

Greg [Slide 2]: This slide shows the meeting topics for today. Next meeting is on Friday, so would like to identify work products for that meeting.

[Slide 3]: Reviewed meeting schedule

[Slide 5]: in this slide, we treated non-detects (NDs) in multiple ways, as 0 of reporting limit (RL), 0.5 of RL, and 1.0 of RL. Kaplan-Meier (KM) sum is the 4th way, running ProUCL on a sample wise basis across congeners. Congener means are pretty much the same for each method. If you see an upper confident limit (UCL) without any label, it's a boot-strapped UCL). For KM sum, we used ProUCL and the ROS [regression on order statistics] method due to weird results with KM. The notes at bottom of slide provide additional information.

Elizabeth: as you pointed out there are very few NDs for PCB congeners. The low frequency of NDs in congener results show that it comes out the same. It's weird that ProUCL came up with 95UCL of 274.

Greg: In the bottom bullet, the H-UCL [H-statistic based UCL] results in a high value. If we choose a lognormal H-UCL on a KM statistic, it yields a very high value. If we see an H-UCL value come out, we usually replace it with an ROS, which lined up perfectly with gamma (same with Chebychev).

Elizabeth: did it recommend an H-UCL?

Greg: yes, but it gives you others, which you can choose.

Debra: That first row is how we've traditionally always handled PCBs for Superfund work whenever we use congener data, by assigning 0 to NDs.

Elizabeth: Substituting 0 for NDs is a substitution method, and I'm always concerned about substitution, but because they are so close, it's not going to make any difference.

Greg: That the summing methods give the same results is good news for the data.

[Slide 6]: Aroclor data are pretty consistent with the congener data. In the top row, we used this method in the EW and LDW, and thus, if we have a ND Aroclor, then it's not included in the sum when another Aroclor is detected, and the sum of your reported values is the value. The other 2 methods are 0.5 and 1.0 times the reported value (RV). In the slide, RL should be RV, but the RL is actually the RV with Aroclors. Only Aroclors 1248, 1254, and 1260 were detected; all other Aroclors were non detect for all samples. The means an increase from 13.8 to 14.4 ug/kg from RV=0 to RV=0.5, which is not a large change. Looking at the data in the first row, from our analytical chemist, she said that if you start to impute values for non-detects, it could lead to double counting of PCBs due to overlapping congener patterns within each Aroclor.

[Slide 7]: The first line is summary statistics including Ecology Aroclor data, and the 2nd line is summary statistics using congener data only. They are very similar. There are 3 samples with all ND Aroclors in the dataset, and the ProUCL values are lining up really closely.

Bill: When was the Aroclor data taken? Wasn't it before the congener data? By including it, would it extend the temporal representation of our dataset?

Greg: The data was taken in 2009, so yes, for PCBs.

Jeff: Wasn't Ecology also collecting congener data?

Debra: not at this time. They only did Aroclors at Manchester lab.

Greg: for dioxin and arsenic, the Ecology data are always part of the dataset because dioxins and arsenic were analyzed along with PCB Aroclors.

[Slide 9]: This table shows summary statistics of different dioxin/furan congeners. We show toxic equivalency factor (TEF) for reference, but nothing is multiplied by TEF to calculate TEQ in this slide. We show 3 different columns for 0, 0.5, and 1.0 times RV, plus KM. It's hard to tease out the results from this slide, but one thing that's worth noting is the large variation in concentration difference for each congener. ODCC is in the 1000s, but TCDD is 2 lines up that is 1,000 times less in concentration.

[Slide 10]: This shows 0 and 1.0 of RV, which is the basis for our previous calculations. This slide shows the percent difference from 0.5 times RV (based on previous slide’s data). For the top row, we had 59 samples and 59 detections, resulting in 0% difference for RV equal to 0 and 1.0. 123789-HXCDF has 19 detections out of 59 samples, so how we handle non-detects for that congener is more important. For congeners with the highest TEFs equal to 1, the ProUCL method lands pretty closely to the 1/2 times the RV method.

Debra: which is what we use for TEQ calculations in RI/FS.

{Slide 11]: this slide shows totals from slide 9. The top row is a sum of means from slide 9. Total concentrations are on the order of 1,200. The middle row multiplies the TEF by each congener (from slide 9) and then totals that. The third row takes each sample and calculates a TEQ and then creates a sum. Rows 2 and 3 are calculating TEQs, but the 2nd row takes averages of each congener, then does a TEQ calculation. Row 3 does a TEQ calculation for each sample and then does summary statistics. This results in only some minor differences in rounding.

[Slide 12]: This slide presents percent differences from 0.5 times RV (based on slide 11), which results in percent differences less than 3%. Congeners with the highest concentrations have less variance and less effect of being ND and therefore has a lower effect on the total. Any questions?

Bill: part of the silence is you've provided good information that is digestible. I'll need to stare at this to think more about it.

Ravi: Yes, this is great, I am also able to follow along.

Greg: [Slide 14]. EWG developed recommendations. For PCBs, this mirrors the status quo of using 0 times the RV for non-detects. For Aroclors, we like keeping the Ecology data to keep the dataset as large as possible and using 0 times RV. For dioxins/furans, we are interested in maintaining the TEQ value, in part for consistency with past work and the summing data show it's a robust method. One way to think about the TEQ is it's a weighted sum of the different congeners with consideration of their toxicity. So in terms of an anthropogenic background number, it could make sense as a weighted sum.

Elizabeth: I'm not in favor of including the Aroclor data because it is a little bit different. You only did the calculations for Aroclor data for which there is no congener data. I'd like to see more comparisons of Aroclors when they were paired with congeners to see how well they matched up, particularly at the lower concentrations. I didn't see a lot of difference between the data summaries when Aroclor data are included with congener data summaries, I think because relatively speaking the Aroclor dataset is really small compared to the congener dataset. If there's some compelling reason in terms of representativeness, we could consider, but I'm not in favor of keeping it in. I don't see any difference by keeping it out.

I'm not particularly keen to keep one non-detect method for one set of analytes and a different method for another set of analytes. It's different when you do it for PCBs, as you apply the same toxicity to it. For D/F, you apply a different toxicity for something that doesn't exist. I’m not in favor of TEQ because it is not found in environment that way. If you do a TEQ sum, you should be including the dioxin-like PCBs, as you apply the dioxin slope factor for those.

Summing the individual congeners and then calculating those statistics is best, and then calculating a TEQ at the end is not inappropriate to do. Going forward, the RAL will be a TEQ, and there is no intent to revisit that. We will need to calculate a TEQ for that sample during post-construction monitoring, but the chromatogram does not show peaks of TEQ, rather it shows individual congeners. Summing on individual congeners is the best way to do it as that's what we'll be comparing to going forward.

Bill: When you're saying summing the individual congeners, you're saying calculating AB with this method?

Elizabeth: For dioxin/furan, toxicity is not the same. It's interesting there is not much variability, and this is very informative. The toxicity is a dependent variable on source. You can have 2 discrete samples that have a different source but the same TEQ. The toxicity is dependent on that ratio, but is not dependent on that ratio for PCBs. Trying to calculate TEQ in the environment results in summing independent variables.

Debra: Is there any concern there could be confusion from folks looking at the Proposed Plan if the natural background value and the risk-based value is D/F TEQ and anthropogenic background is a total? Second question is if thinking about using a total dioxin/furan sum for AB, what if there are challenges of meeting this number in the future. Meaning if it is driven by OCDD, but it's not one of the ones that are more toxic. Wouldn't we want to know that? Wouldn't that come into play about site performance in the future? Could we be missing something by not thinking about the importance of toxicity?

Elizabeth: you will always have toxicity available, but if OCDD is most prevalent, then you will have an individual background value for OCDD. It's no longer about what's the total. We are picking background as a cleanup goal. We have information that the risk-based values are much less than what is occurring anthropogenically in the environment, so we will go with those. For the first question, I'd rather explain that confusion rather than do it incorrectly.

Merv: I tend to agree that from purely a scientific perspective, you want to look at concentrations. When I look at the performance evaluation down the road, I suspect we will also look at the TEQ to evaluate how much risk reduction was achieved. So from the narrowly defined perspective of defining AB concentrations, your approach makes sense, but overall you'll pull the TEQ in at the end.

Elizabeth: My recommendation is to do statistical calculations (90th percentile, mean, and UCL on the mean) for each congener. The congener with 30% detections is a bit troubling. You do a sum and I have no objections to calculating a TEQ based on each congener. For remedy performance, you'll collect a sample and you'll get concentrations on each individual congener that support individual congener comparisons to AB, sum of congeners to AB, and TEQ for each sample to AB TEQ. You'll generate all these numbers anyway, so let's do this calculation properly at the beginning and we can discuss how the remedy is evaluated down the road.

Debra: So we would have AB for 17 congeners and we can convert to TEQ for reference?

Elizabeth: Yes, technically that's fine. I think the information I suggest we generate at this point is the information that we need to generate anyway.

Jeff: On slide 11, this suggests it doesn't matter which way you go. We don't know as additional sources get controlled whether this will stay the same. You get the same TEQ result regardless of which way you do it. This method for summing individual congeners is much more labor intensive. Do we have to go through this extra work every time? Are we putting ourselves into a lot of work with this decision?

Debra: For AB or future monitoring?

Jeff: Both, as we'll have to do this calculation methodology in the future to compare to AB.

Elizabeth: I'm not sure I understand

Jeff: Can Greg explain the amount of work involved?

Elizabeth: I know how much work it is, as I've done this. On Slide 10, say we'll pick a background value on the mean for comparison of remedy performance. You've always calculated these individual concentrations, sum them, and multiply them by TEQ to get an overall TEQ that's coming into the system from background. You've already done the work. The lab will give you these numbers, as someone has to calculate TEQ separately.

Jeff: On Slide 11, if you calculate by congener or calculate by sample, you get the same number. Calculating by sample is a lot simpler as you have to go through these steps with each congener.

Bill: I'm wondering if this similarity is because the data sources are roughly the same, like from the same place in the river, resulting in the same distribution of congeners. I'm wondering if you have different sources of D/F, then this similarity may not bear out.

Jeff: True for pre-cleanup, but post-cleanup, you should be in an environment more similar to AB.

Debra: Elizabeth still prefers to work with individual congeners first and not a TEQ by sample. We're saying it doesn't make any difference whether you do it first or last.

Jeff: You'll get the same dry weight mean, as this is just a weighted mean of a dry weight concentration, so let's use a simpler calculation method in the future.

Elizabeth: That's what I'm not understanding.

Debra: Can you explain that Jeff?

Jeff: You run dry weight by sample and run statistics on them instead of running each congener individually.

Elizabeth: the lab will give you dry weight concentration of each individual congener

Jeff: and the total

Debra: you usually want to do totals after validation

Elizabeth: Somebody has to calculate totals.

Greg: this is an important conversation, but we need to move on. I have some thoughts on false positives and false negatives that we can discuss regarding performance in the future.

Elizabeth: let's discuss more on Friday.

Greg: [Slide 16] This is total PCBs for all types of suspended solids samples with Ecology Aroclor data included. These are log-normal QQ plots. The middle panel is fines normalized, which assumes that all contaminants are associated with fine-grained sediment. This allows apples to apples comparison of centrifuge and filtered data to sediment traps. On the right, we include only samples with greater than 60% fines. The sediment traps do not cluster at the bottom when adjusting for fines.

Bill: what is sample count without sediment traps or fines screening?

Greg: for fines screening, I don’t recall exactly; I think it maybe 3 or 4 samples were removed due to fines screening.

Greg: [Slide 17] Dioxin/furan show the same pattern as PCBs. With fines screening, the lowest samples are excluded on the right.

Debra: Dioxins/furans were analyzed in fewer sediment traps, so there is a smaller n size.

Greg: [Slide 18] Arsenic sediment trap data is correlated with lowest concentrations. If we perform a screening, a number of those data are excluded.

[Slide 19] this table presents a summary statistic of what we saw graphically. The 2nd row excludes sediment traps and was not presented on the previous slides. The 3rd row is the middle pane on the previous graphics. The 4th row is the far righthand panel in the previous graphics.

Debra: you can see the sample count reduces more than 3 to 4 samples by filtering for 60% fines

Greg: Yes, it is more like 10 to 12 samples.

Debra: is your goal to explain the slides today so we could revisit on Friday?

Greg: yes I'd like to present the slides to support discussion on Friday.

Elizabeth: I have a question. I really like the slides. What's the difference in n? If I wanted to include only sediment samples with greater than 60% fines?

Greg: For PCBs we have 65 samples, but 56 if we exclude sed traps. These numbers do include Aroclors.

Greg: [Slide 20]: This graphic is pointing out the percent fines that we see in all the samples. The left hand boxplot is all samples, but as we saw in the EW CSM, only fine grained solids move into the EW.

Jeff: The number for the EW settling is a model result that is leaving LDW, we don't have actual samples.

Greg: maybe EPA can review these before next meeting. I am going to review all the remaining slides in consideration of time remaining and we can discuss at next meeting.

[Slide 22]: When we look quantitatively at the data, we see it consistent with lognormal distributions.

[Slide 23]: The line on these QQ plots is a theoretical lognormal distribution. These plots do include sediment trap data. An outlier at the top of the distribution would be to the left and above the diagonal line. Even the higher values fall within the range. On the low end an outlier would be to the right of the diagonal line.

[Slide 25]: There have been 2 main variables that we have looked at. The first is flow below the Howard Hanson dam, which affects the concentrations we see downstream. We need to understand what is normally happening in the river. This is a histogram of Dam flow from 2001 to 2019, which is the time period we have the rainfall data. The majority of our sampling is from the 2013-2015 timeframe. This histogram data is presented in the table below as well. The prevailing condition is low flow conditions, so the highest bar is the most common condition. Values can go all the way up to 8,000 cfs, but they get more rare. The mean is about 1,000 cfs and the minimum flow is 200cfs, which is required minimum flow by USACE at all times.

[Side 26]: This is rainfall. The left hand side is a histogram of data over 2001-2019 period, and the highest bar is 0 inches/day. On the right hand side, we retained only data for 0.1 in/day only so distribution can be seen easier. There are a few datapoints out by 5 inches/day.

[Slide 27]: The next graphics show 4 dimensions as bubble plots. Flow just below the Howard Hanson dam is on the X axis. Precipitation is on the Y axis. The size of each bubble is concentration (larger bubble equals higher concentration). Color represents season.

[Slide 28]: As the dam flow increases, the size of the dots gets smaller, regardless of season or precipitation. When the dam flows more strongly, the concentrations goes down. On the left, in general, as the precipitation goes up, the concentration increases.

[Slide 29]: Dioxin/furans have a very similar trend as PCBs

[Slide 30]: Arsenic is different. It's the same as PCBs, in that high flow results in lower arsenic concentrations, but concentrations with arsenic are higher with low precipitation and low flow. Higher precipitation results in relatively lower concentrations for arsenic.

[Slide 31]: This table shows the 5 highest concentrations for each chemical. It also shows the event type, which represents if preceding days were drier, which could result in higher concentrations. The percentiles are based on all the data you saw previously for Howard Hanson flow record or rainfall record. For trends, the main takeaway is that with lower flow and higher precipitation, you are most likely to see higher PCBs and dixon/furans. For arsenic, the highest samples also were during low flow events and tended to coincide with no precipitation.

[Slide 32]: Bill and Elizabeth asked for this last meeting. This shows how the dataset would change if we excluded 1 or 2 samples with highest concentrations.

[Slide 33]: Part of next meeting will be to discuss this information. You could communicate what else you want to see today or via email later.

Ravi: I think we need to talk among ourselves and then we can talk more on Friday.

Debra: can you let us know if you want anything else for us to prepare?

Elizabeth: this has been really informative and I appreciate the discussion. I'd be interested in calculating the individual dioxin/furan congeners and then calculating the sum.

Greg: I think that's there. The dioxin/furan presentation started with congeners, then comparison between congeners, and then totals.

Debra: Do you mean repeating these as total congeners rather than TEQ?

Elizabeth: I like that idea. Concentrations vary so much with different conditions. I think we're on the same page up to this point.

Bill: We were going to talk about other weighting factors on the data, for example the importance of storms and base flow for PCBs and dioxins, in particular. Do we want to do any weighting for event type or not? I'm not advocating one way or another, but we talked about doing that.

Elizabeth: were the last slides related to that?

Greg: the last slides were exploratory without getting to a number.

Elizabeth: that's fine. If you haven't taken it any further, that's fine.

Jeff: are you leaning toward any preferred subset?

Elizabeth: this is all very well done and it's leaning towards a way of looking at the data. I suspect you have some recommendations and that you haven't fully flushed out. This meeting is helpful. I'll spend some time this week to play with the data. This is leading us to what data we're using and then calculating the number should be straight forward.

Ravi: Yes this has been a really good process. I appreciate everything this group has put together. I believe if we have any differences we can resolve them sooner than later.

Dan: Looking at the schedule, our next meeting this Friday is to complete the AB discussions and then move to sensitivity analysis the Friday after Thanksgiving.

Ravi: We will get together and let you know if we would like you to prepare anything else.

Greg: We meet at 1 pm tomorrow, so we could review any request you have then.

Pete: so where are we overall on the schedule?

Greg: I feel as a group at the end of next meeting we could have concrete things to calculate. That could slide into the December 4 meeting. If we decide on Friday how to calculate, we could move into December 4 with additional sensitivity analyses.

Pete: so we identify a dataset and then move into calculations?

Greg: Yes, I was thinking that.

Debra: Yes

Allison: Can you summarize the next steps that EPA has required? What exactly is going to happen between now and the next meeting?

Greg: We are going to run a slide for total dioxin/furans and to think about Bill's request about weighting to move the discussion forward.

Ravi: I was going to follow up with everyone to see if there are any other calculations we would like them to do for us.

Elizabeth: I think given the info that's been presented, if you have any idea on weighting, it's possible by the end of the meeting on Friday that we could have the 3 datasets we could use.

Greg: does that schedule sound OK?

Debra: we're hoping to keep moving forward.

Elizabeth: I think we're fine on schedule. If there's a few more things to discuss after next meeting, we should still be fine schedule-wise.